

4

Determinants of the Primary Fiscal Balance: Evidence from a Panel of Countries

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4.1 Introduction

The primary fiscal balance is a key determinant of public debt dynamics. Together with the level of the public debt stock and the differential between the interest rate on public debt and GDP growth, it forms the basis for projecting the future path of a country's public debt. This chapter first reviews some stylized facts about the primary fiscal balance. It then tries to empirically identify the most important underlying determinants of the primary fiscal balance, using cross-country panel data. The final section of the chapter provides an illustrative example showing how to apply the empirical findings to predict a country's primary fiscal balance on the basis of fundamentals.

4.2 Stylized Facts

In view of the need for major fiscal adjustment in the years ahead, especially among the advanced economies, a natural question to ask is how challenging such required adjustments will be by historical standards. Some stylized facts about the primary fiscal balance can help to put in perspective the magnitude of the challenge. Appendix table A4.1 provides the summary statistics for the historical primary fiscal balance of 87 countries during the past few decades.¹ Figure 4.1 shows the frequency plots of the highest primary fiscal surplus for each country.

The first two panels in figure 4.1 show that achieving large primary fiscal surplus in one year is not an unusual event. Over 40 percent of the countries (37 out of 87, or 14 out of 32 advanced economies) had a maximum one-year primary fiscal surplus exceeding 5 percent of GDP.

Nonetheless, a high level of primary fiscal surplus has been maintained over an extended period less frequently, as demonstrated by the next four panels in figure 4.1. Out of the 87 sample countries, only 14 recorded an average primary fiscal surplus higher than 5 percent of GDP over a five-year period.² A further look into these

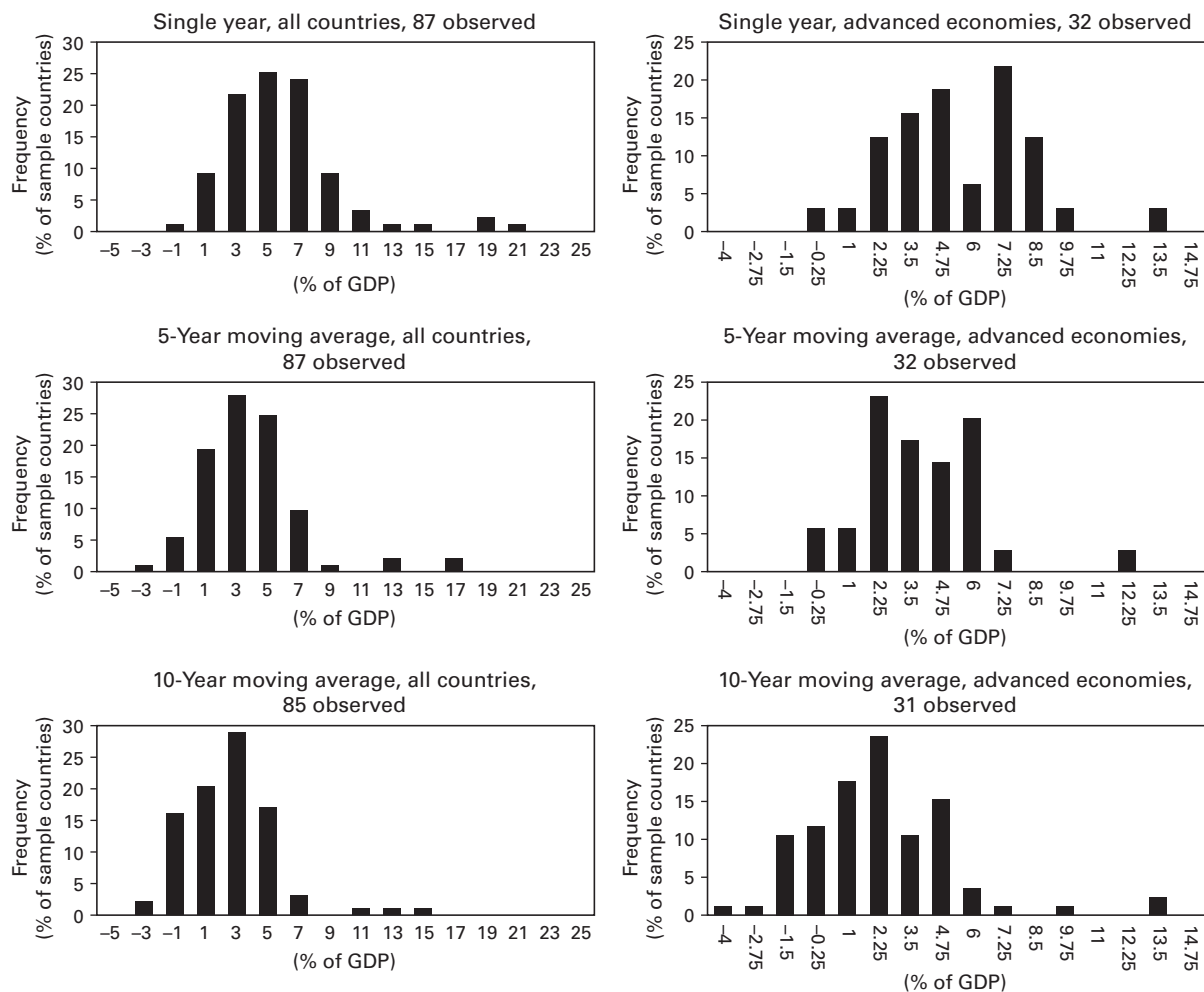


Figure 4.1

Frequency plots of maximum fiscal balance, by country, annual data, 1956 to 2009. The sample excludes oil and primary product exporters, as defined by the WEO, and HIPC MDRI beneficiary countries. Data are available beginning in 1956 for Japan, in the 1960s and 1970s for another 15 advanced economies, in the 1980s for about 30 countries, and in the 1990s for the bulk of the sample. The total number of country-year observations is 2,061.

Source: World Economic Outlook Database

Table 4.1

Episodes of sustained, large primary surpluses

Need to finance large interest bill stemming from high public debt	Revenue boost from natural resource exports and other factors	Strong overall performance, coupled with fiscal prudence
Jamaica * (1988–92, 15.1, 107)	Botswana * (1984–88, 16.5, 32)	Singapore * (1991–95, 11.6, 73)
Seychelles * (1988–92, 8.8, 80)	Egypt * (1993–97, 5.8, 97)	New Zealand * (1993–97, 6.0, 51)
Belgium * (1998–2002, 6.3, 110)	Lesotho ^a (2004–2008 11.1, 62)	Denmark * (1985–89, 5.7, 62)
Dominica (2003–2007, 5.3, 107)		Turkey * (2003–2007, 5.3, 53)
Israel (1987–91, 5.1, 140)		Canada (1997–2001, 5.1, 90)
Panama (1990–94, 5.1, 77)		

Note: Reported in the table are five-year episodes during which countries achieved an average primary fiscal balance above than 5 percent of GDP. The starred countries have recorded more than one such episode. Nonetheless, only the episode with the highest average primary fiscal balance is listed. Reported in the parentheses are (time period / average primary balance as percentage of GDP / average public debt as percent of GDP).

a. The high primary balance of Lesotho during the period 2004 to 2008 was, to a large extent, explained by the receipts from the Southern African Customs Union, which repeatedly exceeded the budget forecast, thanks mostly to buoyant revenues from South Africa.

countries (table 4.1) shows that such large fiscal surpluses by three of them were actually connected to exogenous factors that would be difficult for other countries to replicate—large increases in revenues related to natural resources (Botswana and Egypt) or transfers arising from custom union membership (Lesotho).³ The remaining 11 countries account for less than 15 percent of the sample. If the averaging horizon is lengthened to ten years, then only 4 countries (Belgium, Jamaica, Singapore, and Seychelles), aside from Botswana and Lesotho, recorded an average primary surplus higher than 5 percent of GDP.

It is worth pointing out, though, that having not achieved high levels of primary fiscal balance over an extended period of time does not necessarily mean that the country is incapable of doing so—it may simply have never needed to. For example, countries with low debt-to-GDP ratios, low borrowing costs, and healthy growth would not need to run large primary surpluses. Nevertheless, measuring the required primary fiscal balance for reducing debt against historical benchmarks may be suggestive of how challenging the needed adjustments will be. Investigation of the 14 countries that achieved a five-year moving average primary fiscal balance higher

than 5 percent of GDP reveals that most of them were facing high public debts, exceeding 60 percent of GDP, at the time when they ran large primary surpluses. This is broadly consistently with the notion that countries facing higher debt pressure tend to run higher primary fiscal balance. The effect of debt pressure on the primary fiscal balance will be studied more carefully through regression analysis in the next section.

The role of rapid GDP growth in facilitating large primary surpluses can also be explored through simple charts. The top left-hand side panel in figure 4.2 plots the maximum single-year primary fiscal balance of each country against the real GDP growth of the same period. While most countries registered their best primary fiscal balance when their economies were growing, this cross-country chart seems to suggest that a country's ability to run high primary fiscal balance does not critically

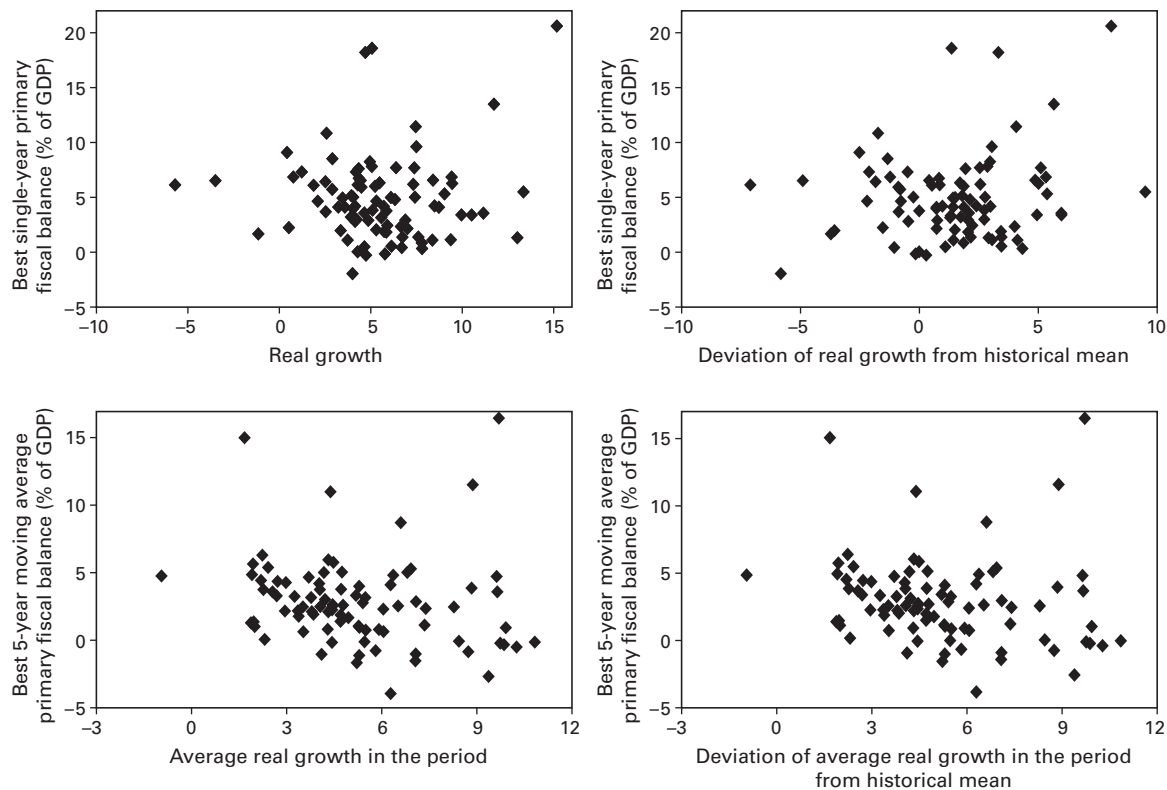


Figure 4.2

Best primary fiscal balance versus growth. The sample consists of 87 countries, with data for 1956 to 2009, subject to availability.

Source: World Economic Outlook Database

hinge upon its GDP growth. The top right-hand side panel in figure 4.2 replaces the real GDP growth in the first chart with its deviation from the countries' historical mean. It shows that more than one-fourth of the countries had their best primary fiscal balance when real growth was below the countries' historical average.

Do such patterns hold at the medium-term frequency? To answer this, the bottom two panels of figure 4.2 report the best primary balance and real growth for five-year (moving) averages. The patterns shown are similar to those seen in the top panels. While most countries achieved their best five-year average primary fiscal balance when the economies were growing, there is no clear cross-country positive correlation between such best five-year average and the corresponding average real growth. The bottom right-hand side panel shows that even in the medium run, more than one-fifth of the countries had their best five-year average primary fiscal balance when the average real growth of the period was below the countries' historical mean.

While figure 4.2 indicates that a country's ability to run large primary fiscal surpluses is not critically constrained by its GDP growth, it should *not* be interpreted as evidence against the positive impact of growth on the primary fiscal balance. There are several reasons. First, figure 4.2 only reports cross-country comparisons of the cases when countries had their best primary fiscal balance. Second, other important determinants of the primary fiscal balance, such as countries' public debt levels, are not taken into account in figure 4.2. Finally, figure 4.2 does not address the potential dual causality between the primary fiscal balance and growth. Thus a more accurate gauge of the growth impact on the primary fiscal balance will require rigorous econometric analysis, incorporating additional time-series perspective, taking cases other than the best-performing episodes into consideration, controlling for other determinants of the primary fiscal balance, and dealing with the endogeneity between growth and the primary fiscal balance carefully. The next section seeks to meet these goals.

4.3 Determinants of the Primary Fiscal Balance

The discussion thus far has focused on the maximum primary fiscal balance that countries have achieved. Such "boundary cases" provide useful references for measuring the challenges facing countries that need large fiscal adjustments. However, a more general question is, in a given environment, what level of primary fiscal balance should reasonably be expected.

This section and the next will try to shed light on this question by first empirically identifying the key underlying determinants of the primary fiscal balance and gauging their quantitative impact through regression analysis, and then providing illustrative examples on how to apply the regression results to relate a country's primary fiscal balance to its fundamentals.

4.3.1 Modeling the Primary Fiscal Balance

This chapter uses two methods to estimate the empirical relation between the primary fiscal balance and its underlying determinants. The first one is the country fixed-effect (FE) model:

$$pb_{i,t} = \alpha_0 + \alpha_i + \beta \cdot X_{i,t} + \varepsilon_{i,t}, \quad (4.1)$$

where $pb_{i,t}$ s country i 's primary fiscal balance, as a share of GDP, in period t ; α_0 s a constant; α_i s the country fixed effect; $X_{i,t}$ a vector of underlying determinants for the primary fiscal balance; and $\varepsilon_{i,t}$ s an error term.

The second method is the dynamic panel data (DPD) model, where the first lag of the primary fiscal balance, $pb_{i,t-1}$ is added to the right hand side of the equation as a regressor:

$$pb_{i,t} = \alpha_0 + \alpha_i + \gamma \cdot pb_{i,t-1} + \beta \cdot X_{i,t} + \varepsilon_{i,t}. \quad (4.2)$$

The lagged dependent variable is included to capture the persistence in the primary fiscal balance. Indeed, it is well known that when a country needs to improve its primary surplus, a given adjustment is often phased in over several years.

4.3.2 Determinants of Primary Fiscal Balance

The previous literature has suggested a wide range of factors that may affect a country's primary fiscal balance (e.g., see Woo 2003).

- *Real GDP Growth (g)*

There are different channels through which economic growth can affect the primary fiscal balance. One is the automatic fiscal stabilizers. For instance, in an economy with a share of revenues equivalent to, say, 40 percent of GDP, a 1 percentage point increase in economic growth would, other things equal, result in a 0.4 percent of GDP improvement in the fiscal balance, under the assumption that government expenditure is inelastic to growth and revenues have unit elasticity vis-à-vis output. In addition to the cyclical factors, the trend of growth may also affect the primary fiscal balance, for example, through its influence on how difficult it is politically to run large primary fiscal balance.⁴

- *Debt-Stabilizing Primary Fiscal Balance (dspb)*

This is the level of primary fiscal balance that a country needs to run to stabilize its public debt as a percent share of GDP. It is the product of the stock level of public debt and the differential between the interest rate on public debt and GDP growth. It captures the impact of the debt stock, the financing conditions and the economic growth in measuring the public debt pressure facing a country. Because countries tend to be forward-looking in assessing their debt pressure, this chapter tries to re-

flect that by constructing the interest-rate and growth differential using, for country i at period t , the average of the WEO vintage forecast on growth for periods $t+1$ to $t+5$.⁵ Ideally, the same should be done for the interest rate as well, so that the constructed differential is fully forward-looking. Unfortunately, doing so would render a loss of too many observations; as a result the implied contemporaneous interest rate on public debt is used in the baseline specification instead.

- *Public Debt Stock as a Share of GDP (d)*

This is another debt pressure measure, included to compliment the debt-stabilizing primary fiscal balance. On the one hand, countries with low initial debt levels might have space to let the public debt grow without causing immediate concerns over sovereign solvency. On the other hand, for countries already burdened with very high public debt stocks, stabilizing the debt may not be enough—they need to run a larger primary fiscal balance to reduce the debt stock over time.⁶

- *Private Savings as a Share of GDP (prisav)*

Private savings may affect a country's primary fiscal balance through financing channels. While for countries with perfect financial market access, the interest rate, a price measure by itself, could be a good indicator of the public financing tightness, quantity measures, such as the private savings, are also needed to give a more complete public financing picture for countries with constrained market access. Higher private savings give the government more room for financing its deficits, and thus could lead to a lower level of primary fiscal balance.

- *Inflation*

The theoretical prediction on how inflation would affect the primary fiscal balance is more ambiguous. On the one hand, as pointed out by Abiad and Ostry (2005), when inflation rises, the primary fiscal balance may improve, because of the Patinkin effects, if expenditures are fixed in nominal terms, or the bracket-creep effects on tax revenues.⁷ On the other hand, higher inflation, as an alternative method for government to lower its real debt burden, could reduce the need to run a high primary fiscal surplus and thus lead to a smaller primary fiscal balance. Which factor is dominant remains an empirical question.

- *ICRG Composite Risk Index (comprisk)*⁸

The primary fiscal balance may be affected by political and institutional factors as well. Political stability and high-quality institutions tend to be associated with high primary fiscal balance. The ICRG composite risk index, where a higher value indicates a more stable political and economic environment, is included to capture such effects.

Compared with the many factors that have been discussed in the literature, only a small set of determinants are included in the regressions here. It is also worth discussing some regressors that are excluded here.

- *Government Revenues as a Share of GDP*

The revenue-to-GDP ratio was used by some early studies as a proxy for a country's revenue-generating capacity and therefore a determinant for the primary fiscal balance. In estimations not reported (for the sake of brevity), the contemporaneous ratio was highly correlated with the primary surplus, but the link was fragile when the lagged revenue ratio or its moving average were used instead, in spite of the high correlation among these series. This suggests that the significant relation between the primary fiscal balance and government revenues might be mainly driven by the direct accounting relation between the two.

- *Other Economic, Political, and Demographic Variables.*

Other economic variables—such as terms of trade—political variables—such as corruption index and the checks-and-balances index—and demographic variables—such as population ratio of age 65 and older—did not seem to bring extra explanatory power to the baseline specifications where the previously discussed determinants were all included. This is possibly due to the high collinearity among these variables.

4.3.3 Sample and Data

The regressions use a panel of 61 countries, comprising 29 advanced economies, 22 emerging market economies and 10 low income countries. The observations used for the baseline specifications range from 1990 to 2007. More detailed information can be found in appendix table A4.1. There are two special notes about the sample.

First, the following countries or episodes, where the primary fiscal balance was largely driven by special factors, are excluded: (1) oil and other primary product exporters;⁹ (2) the Multilateral Debt Relief Initiative (MDRI) beneficiary countries;¹⁰ (3) high-inflation episodes, with inflation rate higher than 35 percent per annum; and (4) three annual observations prior to any fiscal stress episode.¹¹

Second, this study takes advantage of the newly available Historical Public Debt Database (HPDD), compiled by the Fiscal Affairs Department of the IMF, resulting in wider sample coverage than earlier studies. The baseline regressions have over 700 observations, more than double the sample size of IMF (2003) and of Abiad and Ostry (2005). The summary statistics and construction details of the data are provided in appendix table A4.2.

Estimation Results and Robustness Check

One of the concerns in estimating equations (4.1) and (4.2) is the two-way causality between the primary fiscal balance and growth. To alleviate such concerns, all the

fixed-effect models are estimated using the instrumental variable method, with the real growth for each country instrumented by the average growth rate of its largest trade partners. The dynamic panel models are estimated using the Arellano–Bond GMM method, with the real growth treated as endogenous and the average growth rate of the countries' largest trade partners included as an additional instrumental variable.

Baseline Results and Main Robustness Tests

Tables 4.2 and 4.3 report the estimation results of the baseline specifications using the two methods, along with some robustness tests based on simpler specifications or alternative models, including a pooled-data OLS regression and a random-effect model.

The baseline result of the fixed-effect model, in column 1 of table 4.2, shows a significant positive impact of real growth on the primary fiscal balance. It suggests that when the real GDP grows faster by 1 percentage point, the primary fiscal balance is 0.53 percentage point of GDP higher. This result does not seem to be affected

Table 4.2
Fixed-effect model: Baseline and some robustness check

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
Primary balance (% of GDP)	Baseline	Simpler specifications			Alternative models	
Estimator	FE	FE	FE	FE	OLS	RE
Real GDP growth	0.530*** (0.082)	0.544*** (0.082)	0.550*** (0.084)	0.586*** (0.088)	0.702*** (0.114)	0.536*** (0.079)
Debt-stabilizing primary fiscal balance	0.287*** (0.057)	0.290*** (0.057)	0.275*** (0.057)	0.264*** (0.061)	0.281*** (0.062)	0.285*** (0.055)
Debt stock at beginning of period	0.018*** (0.007)	0.014** (0.006)	0.016** (0.007)	0.011 (0.007)	0.033*** (0.004)	0.020*** (0.006)
Private savings	−0.243*** (0.026)	−0.247*** (0.026)	−0.227*** (0.026)		−0.129*** (0.019)	−0.224*** (0.024)
Inflation	0.083*** (0.022)	0.069*** (0.022)		0.053** (0.024)	0.108*** (0.025)	0.080*** (0.022)
ICRG composite risk index	0.064*** (0.022)		0.045** (0.022)	0.073*** (0.024)	0.133*** (0.016)	0.075*** (0.020)
Observations	793	793	793	793	793	793
Number of countries	61	61	61	61	61	61
R-squared	0.567	0.558	0.553	0.499	0.082	

Note: Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table 4.3
Dynamic panel data model: Baseline and some robustness check

Dependent variable: Primary balance (% of GDP)	(1)	(2)	(3)	(4)
	Baseline	Simpler specifications		
Estimator	DPD	DPD	DPD	DPD
Real GDP growth	0.226*** (0.018)	0.247*** (0.023)	0.231*** (0.013)	0.237*** (0.018)
Debt-stabilizing primary fiscal balance	0.212*** (0.018)	0.226*** (0.018)	0.214*** (0.034)	0.206*** (0.016)
Debt stock at beginning of period	0.030*** (0.004)	0.024*** (0.004)	0.024*** (0.002)	0.029*** (0.003)
Private savings	-0.131*** (0.009)	-0.136*** (0.008)	-0.133*** (0.009)	
Inflation	0.062*** (0.007)	0.057*** (0.005)		0.057*** (0.005)
ICRG composite risk index	0.040*** (0.006)		0.015*** (0.004)	0.052*** (0.007)
First lag of primary balance	0.594*** (0.017)	0.571*** (0.022)	0.554*** (0.023)	0.659*** (0.038)
Observations	744	744	744	744
Number of countries	61	61	61	61

Note: Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

much by either dropping some regressors from the specification, columns 2 to 4, or switching to an alternative model, columns 5 and 6 in the table. In fact, the coefficient on real growth would increase to slightly over 0.7, if the pooled-data model is adopted.

The baseline result of the dynamic panel data model, column 1 of table 4.3, also suggests a significant positive growth impact on the primary fiscal balance. The implied steady state coefficient on real growth, 0.56, is indeed close to what was seen in table 4.2, although the immediate growth impact, 0.23, appears to be much smaller.¹² Similar to the fixed-effect model, this result does not seem to be affected much by dropping some regressors from the specification.

The estimation results in tables 4.2 and 4.3 also show that countries tend to respond to higher debt pressure by running a larger primary fiscal balance. The two variables associated with debt pressure, the debt-stabilizing primary fiscal balance and the public debt stock, both have significant positive coefficients under the baseline specifications.

The fixed effect model (table 4.2) suggests that when the debt-stabilizing primary fiscal balance rises by 1 percentage point, countries tend to raise their primary fiscal balance by 0.3 percentage point. The dynamic panel data model (table 4.3) shows a smaller short-term response in the primary fiscal balance to the same shock, 0.2 percentage point; but at the same time it implies a larger steady state impact of a half percentage point.

The coefficient on the public debt stock ranges between 0.01 to 0.02 in the fixed-effect model. The dynamic panel data model indicates a 0.03 short-term impact of debt increase on the primary fiscal balance, which implies a steady state coefficient of 0.07.

The private savings and the ICRG composite risk index both have significant coefficients with expected signs in tables 4.2 and 4.3. The comparison between the results of the two estimation methods indicates a consistent pattern for these two variables: they both seem to have smaller short-term impact but larger steady state influence in the dynamic panel data model than in the fixed-effect model.

While economic theories suggest mixed effects of inflation on the primary fiscal balance, its coefficients in tables 4.2 and 4.3 are all positive and significant. This seems to indicate that, empirically, inflation's primary-balance-enhancing effect dominates its primary-balance-substitute effect. One possible reason for such results is that episodes with high inflation, when its substitution effect for running a primary fiscal balance is most significant, are excluded from the estimation sample.¹³

4.3.4 Further Robustness Check: Outliers and Alternative Samples

This part runs more robustness tests to check whether the baseline results are driven by outliers or whether they would change substantially with alternative estimation samples.

To test whether the estimation results are driven by outliers, the baseline specifications are re-estimated excluding those observations with tail residuals. The chapter applied three different thresholds for identifying outliers, 1 percent, 2 percent, and 5 percent. Since the results are similar, only the estimations excluding 2 percent observations are reported in tables 4.4 and 4.5. Comparisons with the baseline results show that they are qualitatively the same and quantitatively close.

Another robustness test is to re-estimate the baseline specifications while dropping one sample country at a time. The purpose is to check whether the baseline results were driven by the observations of any specific country. The result summary of those estimations, reported in table 4.6, shows that all the coefficients remain in a reasonably small range around those obtained with the full sample. This finding suggests that the baseline results were not driven by any specific country in the sample.

The baseline regressions excluded three annual observations prior to each fiscal stress episode. To test whether such selection on the sample had a critical impact

Table 4.4
Fixed-effect model: Excluding outliers and with alternative samples

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Exclude	Exclude 10 annual	Not exclude	Include	Exclude major
Primary balance (% of GDP)	2% outliers	observations prior to fiscal stress episodes	obs. prior to fiscal stress episodes	2008–2009 observations	political conflict episodes
Real GDP growth	0.588*** (0.082)	0.583*** (0.099)	0.478*** (0.072)	0.454*** (0.036)	0.515*** (0.083)
Debt-stabilizing primary fiscal balance	0.346*** (0.053)	0.308*** (0.064)	0.295*** (0.051)	0.268*** (0.050)	0.274*** (0.058)
Debt stock at beginning of period	0.020*** (0.006)	0.026*** (0.009)	0.023*** (0.006)	0.022*** (0.006)	0.017** (0.007)
Private savings	−0.246*** (0.024)	−0.278*** (0.030)	−0.228*** (0.023)	−0.190*** (0.023)	−0.248*** (0.029)
Inflation	0.077*** (0.021)	0.090*** (0.030)	0.071*** (0.019)	0.062*** (0.020)	0.085*** (0.023)
ICRG composite risk index	0.057*** (0.020)	0.078*** (0.025)	0.070*** (0.020)	0.084*** (0.021)	0.060** (0.025)
Observations	779	657	888	904	709
Number of countries	61	57	61	61	54
R-squared	0.615	0.569	0.576	0.589	0.556

Note: Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

on the estimation results, the models are re-estimated with two alternative selection criteria: exclude 10 annual observations prior to each fiscal stress episode, or exclude no observations at all. The results are reported in columns 2 and 3 of tables 4.4 and 4.5. The estimations in column 4 of the two tables include observations of 2008 and 2009, while those in column 5 exclude major political conflict episodes from the sample.¹⁴ Although the coefficients based on these alternative samples exhibit different sizes, with mixed patterns, from the baseline results, the qualitative conclusions always remain unchanged.

4.3.5 Further Robustness Check: Alternative Interest-Rate Measures

Table 4.7 tests the baseline results using alternative interest-rate measures.

As discussed earlier, countries are, or should be, forward-looking in assessing their debt sustainability. However, owing to limited data availability, the implied contemporaneous nominal interest rate on public debt was used to construct the interest-rate and growth differential, in the calculation of the debt-stabilizing primary fiscal balance. In columns 1 and 3 of the table, this interest rate for period t is replaced by

Table 4.5
Dynamic panel data model: Excluding outliers and with alternative samples

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Primary balance (% of GDP)	Exclude 2% outliers	Exclude 10 annual observation prior to fiscal stress episodes	Not exclude observations prior to fiscal stress episodes	Include 2008–2009 observations	Exclude major political conflict episodes
Real GDP growth	0.206*** (0.013)	0.228*** (0.014)	0.213*** (0.016)	0.281*** (0.014)	0.275*** (0.021)
Debt-stabilizing primary fiscal balance	0.174*** (0.015)	0.218*** (0.020)	0.251*** (0.020)	0.336*** (0.046)	0.229*** (0.016)
Debt stock at beginning of period	0.039*** (0.003)	0.045*** (0.005)	0.032*** (0.004)	0.039*** (0.006)	0.019*** (0.005)
Private savings	−0.107*** (0.010)	−0.148*** (0.006)	−0.129*** (0.007)	−0.117*** (0.010)	−0.141*** (0.009)
Inflation	0.063*** (0.005)	0.069*** (0.006)	0.045*** (0.005)	0.069*** (0.005)	0.079*** (0.007)
ICRG composite risk index	0.048*** (0.006)	0.063*** (0.008)	0.037*** (0.006)	0.072*** (0.013)	0.039*** (0.005)
First lag of primary balance	0.582*** (0.035)	0.567*** (0.026)	0.522*** (0.026)	0.573*** (0.025)	0.513*** (0.036)
Observations	732	612	832	855	667
Number of countries	61	57	61	61	54

Note: Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

the average of periods t , $t + 1$ and $t + 2$. This implicitly assumes that the government has perfect foresight on its future interest rate and brings more forward-looking aspect to the calculated debt-stabilizing primary fiscal balance. The regressions reported in columns 2 and 4 of the table are similar, but they use the moving average interest rate of period $t - 1$, t and $t + 1$ instead. The estimation results based on these specifications are again qualitatively the same as, and quantitatively close to, the baseline results.

4.3.6 Further Robustness Check: Alternative Debt Pressure Measures

Tables 4.8 and 4.9 reports more robustness test results with alternative debt pressure measures.

In columns 1 to 3, the average of the contemporary vintage of the *WEO* forecast for economic growth, used to calculate the interest-rate and growth differential, is replaced by the average of actual future growth. This alternative approach is

Table 4.6
Result summary of estimations dropping one sample country at a time

Variable	Number of estimations	Mean	Standard deviation	Min	
<i>Fixed-effect model</i>					
Real GDP growth rate	61	0.529	0.014	0.499	0.596
Debt-stabilizing primary fiscal balance	61	0.286	0.019	0.178	0.317
Stock of public debt	61	0.018	0.003	0.012	0.036
Private savings	61	-0.242	0.009	-0.267	-0.194
Inflation	61	0.083	0.004	0.068	0.095
ICRG composite risk index	61	0.064	0.006	0.042	0.085
<i>Dynamic panel data model</i>					
Real GDP growth rate	61	0.239	0.019	0.202	0.298
Debt-stabilizing primary fiscal balance	61	0.219	0.018	0.165	0.263
Stock of public debt	61	0.030	0.004	0.020	0.038
Private savings	61	-0.135	0.006	-0.147	-0.121
Inflation	61	0.064	0.005	0.055	0.078
ICRG composite risk index	61	0.042	0.004	0.031	0.052
First lag of primary fiscal balance	61	0.576	0.022	0.521	0.618

equivalent to assuming that the country's authorities have perfect foresight regarding its future economic growth. The interest rates used in these three columns correspond to the baseline specification and the two alternative interest-rate measures used in table 4.7, respectively. As shown in the tables, the coefficients on real growth, private savings, inflation and ICRG composite risk index, all remain highly significant and close in size to those under the baseline specifications. The coefficients for the debt-stabilizing primary fiscal balance, while showing more variation in size, also remain highly significant with the expected signs.

Estimations in column 4 of tables 4.8 and 4.9 use the interest-rate and growth differential, together with the public debt stock, to gauge the debt pressure facing a country. Those in column 5 again use the debt-stabilizing primary fiscal balance, but it is set to zero when it has negative values. This is to test whether the frequent sign switch of the debt-stabilizing primary fiscal balance in some countries, which happens when the interest rate and growth are close to each other, have significant impact on the regression results. The results for all other regressors turn out to be similar to those under the baseline specifications. The previous conclusion that countries tend to raise their primary fiscal balance when facing increased debt pressure is also confirmed by the significant positive coefficients on the new debt pressure variables.

Table 4.7
Alternative interest-rate measures

Dependent variable: Primary balance (% of GDP)	(1) FE ^a	(2) FE ^b	(3) DPD ^a	(4) DPD ^b
Real GDP growth	0.514*** (0.081)	0.537*** (0.083)	0.232*** (0.015)	0.229*** (0.022)
Debt-stabilizing primary fiscal balance (alternative 1)	0.260*** (0.063)		0.195*** (0.020)	
Debt-stabilizing primary fiscal balance (alternative 2)		0.226*** (0.057)		0.151*** (0.022)
Debt stock at beginning of period	0.018*** (0.007)	0.012* (0.007)	0.032*** (0.004)	0.024*** (0.007)
Private savings	-0.239*** (0.026)	-0.232*** (0.027)	-0.135*** (0.010)	-0.126*** (0.008)
Inflation	0.086*** (0.023)	0.080*** (0.024)	0.067*** (0.005)	0.069*** (0.006)
ICRG composite risk index	0.061*** (0.022)	0.068*** (0.023)	0.045*** (0.008)	0.045*** (0.007)
First lag of primary balance			0.566*** (0.018)	0.552*** (0.037)
Observations	792	775	743	727
Number of countries	61	61	61	60
R-squared	0.565	0.554		

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a. In calculation of the debt-stabilizing primary balance, the contemporaneous real interest rate is replaced by the moving averaging of periods t , $t + 1$, and $t + 2$.

b. In calculation of the debt-stabilizing primary balance, the contemporaneous real interest rate is replaced by the moving averaging of periods $t - 1$, t , and $t + 1$.

4.3.7 Nonlinearity in Debt Stock

The regressions reported in table 4.10, by introducing nonlinearity in d to the models, try to test the notion that countries would act more aggressively to reduce the public debt after it exceeds a certain threshold. The regressions in columns 1 and 3 achieve this by including a higher order term of d as an additional regressor, while those in columns 2 and 4 add a spline for d at the threshold of 60 percent of GDP, a widely used indicative level for a more vigilant watch on a country's debt sustainability.

There seems to be little evidence of nonlinearities in the relationship between the primary fiscal balance and the debt-to-GDP ratio. For the fixed-effect model, both coefficients on the public debt and its square are insignificant in column 1. In column 2, contrary to what one would expect, the coefficient on the over-threshold part of

Table 4.8
Fixed-effect model: Alternative measures of debt pressure

Dependent variable: Primary balance (% of GDP)	(1) FE ^a	(2) FE	(3) FE ^{a,c}	(4) FE	(5) FE ^d
Real GDP growth	0.502*** (0.080)	0.498*** (0.080)	0.517*** (0.082)	0.550*** (0.085)	0.519*** (0.083)
Debt-stabilizing primary fiscal balance	0.113*** (0.040)				
Debt-stabilizing primary fiscal balance (alternative 1)		0.083** (0.042)			
Debt-stabilizing primary fiscal balance (alternative 2)			0.077* (0.043)		
Interest-rate and growth differential				0.178*** (0.038)	
Nonnegative debt-stabilizing primary balance					0.268*** (0.093)
Debt stock at beginning of period	0.024*** (0.007)	0.021*** (0.007)	0.018** (0.007)	0.017** (0.007)	0.014** (0.007)
Private savings	-0.233*** (0.026)	-0.232*** (0.026)	-0.226*** (0.027)	-0.246*** (0.026)	-0.249*** (0.027)
Inflation	0.074*** (0.022)	0.075*** (0.022)	0.072*** (0.024)	0.084*** (0.023)	0.066*** (0.022)
ICRG composite risk index	0.066*** (0.022)	0.065*** (0.022)	0.066*** (0.023)	0.073*** (0.022)	0.071*** (0.022)
Observations	792	792	775	793	793
R-squared	0.563	0.561	0.552	0.561	0.558

Note: Standard errors are in parentheses; *** $- < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a. Perfect foresight is assumed in calculating forward-looking real growth.

b. Contemporaneous real interest rate is replaced by the moving average of periods t , $t + 1$, and $t + 2$.

c. Contemporaneous real interest rate is replaced by the moving average of periods $t - 1$, t , and $t + 1$.

d. Negative forward-looking debt-stabilizing primary balance is replaced by zero.

Table 4.9
Dynamic panel data model: Alternative measures of debt pressure

Dependent variable: Primary balance (% of GDP)	(1) DPD ^a	(2) DPD ^{a,b}	(3) DPD ^{a,c}	(4) DPD	(5) DPD ^d
Real GDP growth	0.250*** (0.020)	0.223*** (0.019)	0.207*** (0.016)	0.221*** (0.015)	0.238*** (0.019)
Debt-stabilizing primary fiscal balance	0.137*** (0.023)				
Debt-stabilizing primary fiscal balance (alternative 1)		0.120*** (0.028)			
Debt-stabilizing primary fiscal balance (alternative 2)			0.127*** (0.022)		
Interest-rate and growth differential				0.109*** (0.013)	
Nonnegative debt-stabilizing primary balance					0.203*** (0.037)
Debt stock at beginning of period	0.032*** (0.005)	0.031*** (0.005)	0.037*** (0.005)	0.031*** (0.039)	0.026*** (0.020)
Private savings	-0.122*** (0.008)	-0.126*** (0.006)	-0.136*** (0.010)	-0.140*** (0.009)	-0.143*** (0.008)
Inflation	0.067*** (0.008)	0.066*** (0.006)	0.065*** (0.005)	0.055*** (0.005)	0.056*** (0.004)
ICRG composite risk index	0.042*** (0.007)	0.036*** (0.005)	0.037*** (0.006)	0.044*** (0.006)	0.042*** (0.005)
First lag of primary balance	0.576*** (0.023)	0.564*** (0.030)	0.606*** (0.014)	0.575*** (0.039)	0.573*** (0.020)
Observations	768	768	751	744	744
Number of countries	61	61	60	61	61

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a. Perfect foresight is assumed in calculating forward-looking real growth.

b. Contemporaneous real interest rate is replaced by the moving average of periods t , $t + 1$, and $t + 2$.

c. Contemporaneous real interest rate is replaced by the moving average of periods $t - 1$, t , and $t + 1$.

d. Negative forward-looking debt-stabilizing primary balance is replaced by zero.

Table 4.10
Nonlinearity in debt stock

Dependent variable: Primary balance (% of GDP)	(1) FE	(2) FE	(3) DPD	(4) DPD
Real GDP growth	0.530*** (0.083)	0.527*** (0.083)	0.242*** (0.016)	0.242*** (0.024)
Debt-stabilizing primary fiscal balance	0.287*** (0.057)	0.287*** (0.056)	0.230*** (0.017)	0.228*** (0.020)
Debt stock at beginning of period	0.017 (0.018)		0.060*** (0.007)	
Debt stock at beginning of period (squared)	0.001 (0.010)		-0.016*** (0.003)	
Debt below 60% of GDP		0.023* (0.014)		0.050*** (0.006)
Debt above 60% of GDP		0.017** (0.008)		0.025*** (0.005)
Private savings	-0.243*** (0.026)	-0.242*** (0.026)	-0.141*** (0.008)	-0.126*** (0.010)
Inflation	0.083*** (0.022)	0.083*** (0.022)	0.062*** (0.005)	0.070*** (0.009)
ICRG composite risk index	0.064*** (0.022)	0.065*** (0.022)	0.045*** (0.005)	0.049*** (0.008)
First lag of primary balance			0.551*** (0.037)	0.571*** (0.027)
Observations	793	793	744	744
Number of countries	61	61	61	61
R-squared	0.567	0.568		

Note: Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

the public debt is actually smaller than the one on the below-threshold debt. For the dynamic panel data model, the coefficient on d^2 is negative in column 3, which seems inconsistent with the view that higher debt has an increasingly strong and positive impact on the primary balance. Similar to the fixed-effect model, the estimation result in column 4 shows a smaller coefficient for the over-threshold part of debt than the below-threshold portion.

4.3.8 Subsample Results

Tables 4.11 and 4.12 report the estimation results for subsamples separating the advanced economies from other countries. There are some interesting differences between the estimated coefficients for the two subsamples.

Table 4.11
Fixed-effect model: Subsample results

Dependent variable: Primary balance (% of GDP)	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	FE		FE		FE		FE		FE		FE		FE		FE	
	Advanced economies															
Real GDP growth	0.690*** (0.097)		0.697*** (0.096)		0.667*** (0.096)		0.770*** (0.105)		0.397*** (0.123)		0.423*** (0.125)		0.431*** (0.129)		0.434*** (0.132)	
Debt-stabilizing primary fiscal balance	0.331*** (0.115)		0.306*** (0.115)		0.409*** (0.115)		0.011 (0.117)		0.375*** (0.065)		0.384*** (0.066)		0.370*** (0.066)		0.416*** (0.069)	
Debt stock at beginning of period	-0.012 (0.009)		-0.013 (0.009)		-0.022*** (0.008)		-0.014 (0.010)		0.065*** (0.010)		0.054*** (0.009)		0.063*** (0.010)		0.057*** (0.010)	
Private savings	-0.341*** (0.044)		-0.351*** (0.044)		-0.321*** (0.044)				-0.189*** (0.031)		-0.186*** (0.032)		-0.178*** (0.032)			
Inflation	0.243*** (0.071)		0.230*** (0.071)				0.188** (0.076)		0.052** (0.021)		0.035 (0.022)				0.036 (0.023)	
ICRG composite risk index	0.077* (0.046)				0.060 (0.046)		0.117** (0.049)		0.085*** (0.024)				0.071*** (0.024)		0.081*** (0.025)	
Observations	433		433		433		433		360		360		360		360	
Number of countries	29		29		29		29		32		32		32		32	
R-squared	0.646		0.643		0.638		0.581		0.558		0.524		0.531		0.487	

Note: Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4.12
Dynamic panel data model: Subsample results

Dependent variable: Primary balance (% of GDP)	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD	DPD
	Advanced economies															
Real GDP growth	0.399*** (0.037)	0.446*** (0.036)	0.398*** (0.030)	0.383*** (0.020)	0.095** (0.042)	0.193*** (0.048)	0.113*** (0.036)	0.168*** (0.052)	Other countries							
Debt-stabilizing primary fiscal balance	0.160 (0.099)	0.468*** (0.158)	0.299** (0.120)	0.159 (0.282)	0.337*** (0.038)	0.291*** (0.016)	0.296*** (0.026)	0.301*** (0.018)								
Debt stock at beginning of period	0.033*** (0.009)	0.038*** (0.011)	0.041*** (0.011)	0.042*** (0.014)	0.071*** (0.012)	0.044*** (0.010)	0.058*** (0.008)	0.050*** (0.007)								
Private savings	-0.177*** (0.031)	-0.216*** (0.027)	-0.122*** (0.017)		-0.121*** (0.011)	-0.113*** (0.011)	-0.116*** (0.009)									
Inflation	0.107*** (0.021)	0.044 (0.029)		0.063** (0.026)	0.029** (0.014)	0.026** (0.013)		0.040*** (0.013)								
ICRG composite risk index	0.030 (0.022)		0.012 (0.021)	0.058** (0.024)	0.070*** (0.017)		0.044*** (0.015)	0.061*** (0.013)								
First lag of primary balance	0.658*** (0.054)	0.669*** (0.080)	0.784*** (0.069)	0.774*** (0.115)	0.418*** (0.066)	0.283*** (0.058)	0.342*** (0.086)	0.336*** (0.112)								
Observations	405	408	405	405	339	341	339	339								
Number of countries	29	29	29	29	32	32	32	32								

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

On the one hand, under both the fixed-effect and dynamic panel data models, the positive impact of growth on the primary fiscal balance is estimated to be larger in the subsample consisting of the advanced economies than for the other countries. This could be an indication that the automatic fiscal stabilizers are larger in the advanced economies or that their fiscal policies are more countercyclical than those in other countries. On the other hand, the primary fiscal balances of the advanced economies seem to be less responsive to debt pressure. This is particularly evident if one compares the coefficients on the public debt stock for the two groups of countries. The advanced economies consistently have smaller coefficients, which even turn negative under the fixed-effect model, albeit mostly insignificant. The advanced economies also receive smaller coefficients on the debt-stabilizing primary fiscal balance under most specifications. Overall, these results seem to be broadly consistent with the common wisdom that, under normal circumstances, the advanced economies have better access to the financial markets and can therefore handle debt pressure with less urgency than other countries.

Under all specifications in the two tables, the size of the coefficient on the private savings is larger (more negative) for the advanced economies than for the other country group. This seems consistent with the fact that financial markets are better developed in the advanced economies, which makes it easier for their governments to tap domestic private savings for public financing. The regression results also show that inflation has a larger positive impact on the primary fiscal balance in the advanced economies than in other countries. While this seems contradictory to the view that inflation is less of a public financing tool in the advanced economies than in the emerging and low income countries, it is actually consistent with the recent finding by Reinhart and Sbrancia (2011) that inflation was an important channel for the advanced economies to liquidate their public debt. Since most advanced economies have a relatively stable political environment and high quality institutions, one would expect the ICRG composite risk index to matter less among them. The results shown in the tables appear to be consistent with this: while the coefficient for the ICRG composite risk index is positive and significant under all specifications for the emerging and low-income country group, it is statistically insignificant in half of the specifications for the advanced economies.

4.4 Application: Predicting the Primary Fiscal Balance on the Basis of Fundamentals

The previous section identified important determinants for the primary fiscal balance and estimated their quantitative impact. This section illustrates one application of these results—to project primary fiscal balance benchmark for countries, that is, the level of primary fiscal balance that countries are expected to run given their fundamentals.

The application using the fixed-effect model is straightforward: for any period t , plugging the set of fundamentals $X_{i,t}$ into equation (4.1') will produce the model-based primary balance benchmark $\widehat{pb}_{i,t}$:

$$\widehat{pb}_{i,t} = \hat{\alpha}_0 + \hat{\alpha}_i + \hat{\beta} \cdot X_{i,t}. \quad (4.1')$$

If the dynamic panel data method is used, there are two possible ways to proceed. Supposing that forecasts on the underlying determinants are available for each year within the projection horizon, the future primary fiscal balance can be computed out recursively using equation (4.2'):

$$\widehat{pb}_{i,t} = \hat{\alpha}_0 + \hat{\alpha}_i + \hat{\gamma} \cdot pb_{i,t-1} + \hat{\beta} \cdot X_{i,t}. \quad (4.2')$$

The other way to apply the dynamic panel data method is based on the steady state relation implied by the model, which directly projects the medium-term primary fiscal balance benchmark, pb_i^* by plugging the medium-term fundamental forecast, X_i^* into equation (4.3):

$$pb_i^* = \frac{\hat{\alpha}_0}{1-\hat{\gamma}} + \frac{\hat{\alpha}_i}{1-\hat{\gamma}} + \frac{\hat{\beta}}{1-\hat{\gamma}} \cdot X_i^*. \quad (4.3)$$

For illustration purpose, this chapter takes its medium-term forecasts of the fundamentals from the last available projection by the *WEO* and predicts the primary fiscal balance benchmark for each country in the sample by applying the second method for the dynamic panel data model.¹⁵ To show how the underlying determinants are driving the projections, table 4.13 reports the summary forecasts, along with the decomposition by contributions of the determinants, for four country groups: advanced economies and the other countries are considered separately, and each of these groups is further subdivided depending on whether the model predicts a positive or negative primary fiscal balance benchmark for the country.

The table shows some interesting contrasts between the advanced economies and the rest countries. On the one hand, since the emerging market and low income countries are expected to grow faster in the medium term and tend to have higher inflation, the model predicts that they should run higher primary fiscal balances than the advanced economies. On the other hand, other factors work in the opposite direction. For instance, the emerging market and low income countries are projected to face, on average, smaller public debt pressure than the advanced economies, as indicated by both the debt-stabilizing primary fiscal balance and the level of public debt stock. In addition the political environment and institution quality tend to be less favorable in these countries. Both factors suggest that they might run lower primary fiscal balances than the advanced countries.

There are also interesting comparisons between the countries with negative primary balance benchmarks and those with positive benchmarks. Table 4.9 indicates

Table 4.13
Country group comparison: Projected medium-term primary fiscal balance benchmark

Country group	Contribution of each component to the primary fiscal balance benchmark								
	Medium-term primary fiscal balance benchmark	Real GDP Growth	Debt-stabilizing primary fiscal balance	Debt stock at beginning of period	Private savings	Inflation	Composite risk index	Country effect	Constant
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Advanced economies w. negative benchmarks	-1.5	1.4	0.0	1.4	-5.1	0.2	5.0	-1.5	-2.9
Advanced economies w. positive benchmarks	2.3	1.3	0.1	1.3	-4.4	0.2	5.2	1.5	-2.9
Other countries w. negative benchmarks	-2.1	2.5	-0.3	0.9	-5.4	0.3	4.4	-1.7	-2.9
Other countries w. positive benchmarks	1.6	2.6	-0.3	0.8	-3.7	0.4	4.3	0.5	-2.9

that the countries with negative primary balance benchmarks on average have higher private savings rates, and they tend to have poorer historical performance, as reflected by the smaller country fixed effects.

Having computed the primary fiscal balance benchmarks on the basis of fundamentals, one could carry out additional exercises by comparing them to other references. For instance, the predicted benchmark can be compared to the debt-stabilizing primary fiscal balance. If the predicted primary fiscal balance benchmark is above what is required to stabilize the debt, one could be more inclined to expect that stabilizing the debt would not require extraordinary efforts compared with the past. Conversely, if the predicted benchmark is below the debt-stabilizing primary fiscal balance, this is an indication by the model that additional adjustment policies may be needed to stabilize the country's public debt. The predicted benchmark can also be compared to the primary fiscal balance projections obtained through other methods, including those by IMF country desk economists or other forecasters. While the model takes a cross-country perspective and projects the primary fiscal balance based on historical experience, the forecasts by IMF desk economists, for example, tend to take more country specific factors into consideration, especially planned reforms.

Appendix

Table A4.1
Historical primary fiscal balance information

IFS Code	Country	First observed	Last observed	Total observed	Min	Max	Mean	Standard deviation	In regression sample ^a
111	United States	1960	2009	50	-10.88	4.20	-00.34	2.37	Yes
112	United Kingdom	1979	2009	31	-10.02	3.21	-1.06	2.84	Yes
122	Austria	1978	2009	32	-4.20	2.24	-0.41	1.45	Yes
124	Belgium	1979	2009	31	-7.38	6.85	2.39	3.71	Yes
128	Denmark	1976	2009	34	-6.42	8.25	2.06	3.21	Yes
132	France	1970	2009	38	-5.01	1.89	-0.53	1.46	Yes
134	Germany	1977	2009	33	-2.09	4.11	0.02	1.39	Yes
136	Italy	1980	2009	30	-5.85	6.10	0.18	3.45	Yes
137	Luxembourg	1980	2009	30	-3.01	6.42	2.16	2.21	Yes
138	Netherlands	1980	2009	30	-2.54	5.15	0.76	1.97	Yes
144	Sweden	1980	2009	30	-11.67	4.94	-0.73	4.37	Yes
146	Switzerland	1983	2009	27	-1.88	4.11	1.09	1.53	No
156	Canada	1961	2009	49	-5.26	6.01	0.54	3.10	Yes
158	Japan	1956	2009	54	-9.20	3.16	-1.47	2.99	Yes
172	Finland	1976	2009	32	-8.59	7.81	1.16	3.96	Yes
174	Greece	1988	2009	22	-6.82	4.65	0.10	3.41	Yes
176	Iceland	1973	2009	37	-7.48	6.74	0.37	2.78	Yes
178	Ireland	1976	2009	34	-14.48	6.27	-1.27	5.96	Yes
181	Malta	1995	2009	15	-6.82	1.10	-2.78	2.83	Yes
182	Portugal	1980	2009	30	-4.21	2.34	-0.72	1.81	Yes
184	Spain	1980	2009	30	-10.90	3.33	-0.74	2.96	Yes
186	Turkey	1991	2009	19	-2.63	6.56	1.94	3.03	Yes
193	Australia	1970	2009	40	-3.28	3.98	0.10	1.99	Yes
196	New Zealand	1984	2009	26	-1.72	7.61	2.91	2.72	Yes
199	South Africa	1980	2009	30	-3.36	3.83	0.30	2.48	Yes
213	Argentina	1992	2009	18	-1.35	5.31	1.36	1.96	Yes
223	Brazil	1996	2009	14	-0.89	4.18	2.62	1.73	Yes
233	Colombia	1989	2009	21	-1.92	3.69	1.54	1.61	Yes
238	Costa Rica	1993	2009	17	-2.41	5.02	1.91	1.80	Yes
243	Dominican Republic	1980	2009	30	-5.54	3.39	-1.26	1.96	Yes
253	El Salvador	1990	2009	20	-5.00	0.49	-1.43	1.58	Yes
283	Panama	1982	2009	28	-2.94	6.85	2.90	2.59	Yes

(continued)

Table A4.1
(continued)

IFS Code	Country	First observed	Last observed	Total observed	Min	Max	Mean	Standard deviation	In regression sample ^a
288	Paraguay	1977	2009	33	-3.29	5.73	0.74	2.10	Yes
298	Uruguay	1993	2009	17	-1.86	3.57	0.45	1.65	Yes
313	Bahamas	1991	2009	19	-3.92	2.99	0.46	1.50	Yes
316	Barbados	1985	2009	25	-4.82	6.13	1.09	3.41	No
321	Dominica	1986	2009	24	-5.56	7.69	1.40	3.84	No
343	Jamaica	1983	2009	27	-5.06	18.21	8.55	5.19	No
362	St. Lucia	1983	2009	27	-4.76	5.49	0.19	2.66	No
423	Cyprus	1988	2009	22	-3.06	6.54	0.75	2.33	Yes
436	Israel	1987	2009	23	-2.83	9.62	1.89	2.53	No
439	Jordan	1993	2009	17	-4.06	5.93	0.51	2.70	Yes
446	Lebanon	1992	2009	18	-19.00	2.81	-3.80	6.99	Yes
469	Egypt	1984	2009	26	-19.07	7.31	-3.32	8.13	Yes
514	Bhutan	1993	2009	17	-8.39	4.66	-0.92	4.03	No
518	Myanmar	1995	2009	15	-7.41	-1.95	-4.11	1.50	No
522	Cambodia	1996	2009	14	-4.22	0.43	-1.61	1.45	No
524	Sri Lanka	1986	2003	18	-6.74	0.04	-2.51	1.74	Yes
532	Hong Kong SAR	2005	2009	5	-3.31	7.70	1.95	4.18	Yes
534	India	1991	2009	19	-4.81	1.13	-2.51	1.45	Yes
542	Korea	1979	2009	31	-0.91	4.22	1.60	1.32	No
548	Malaysia	1995	2009	15	-3.35	6.19	-0.21	3.05	Yes
556	Maldives	1979	2007	29	-21.62	4.10	-5.75	6.31	No
564	Pakistan	1994	2009	16	-2.51	2.90	0.36	1.52	Yes
576	Singapore	1990	2009	20	1.79	13.49	7.36	3.39	Yes
616	Botswana	1980	2009	30	-9.64	20.61	5.90	7.11	No
624	Cape Verde	1986	2009	24	-17.48	0.85	-5.49	4.65	No
664	Kenya	1980	2009	30	-4.06	6.14	0.85	2.54	Yes
666	Lesotho	1980	2009	30	-16.25	18.59	0.35	8.57	No
684	Mauritius	1980	2009	30	-8.76	3.56	-0.94	2.94	No
686	Morocco	1970	2009	40	-15.42	5.02	-1.25	4.72	Yes
718	Seychelles	1983	2009	27	-14.29	11.44	1.31	6.77	No
728	Namibia	1993	2009	17	-4.26	6.32	-0.52	2.67	No
734	Swaziland	1980	2009	27	-3.45	8.52	0.38	3.31	No
744	Tunisia	1981	2009	29	-5.64	10.84	0.22	2.99	Yes
819	Fiji	1990	2009	20	-3.97	7.32	0.19	2.88	No
846	Vanuatu	1981	2007	27	-7.25	9.09	-0.91	3.73	No
913	Belarus	1996	2009	14	-2.52	1.97	0.00	1.33	No

Table A4.1
(continued)

IFS Code	Country	First observed	Last observed	Total observed	Min	Max	Mean	Standard deviation	In regression sample ^a
914	Albania	1994	2009	16	-8.97	-0.16	-3.28	2.85	Yes
915	Georgia	1995	2009	15	-8.42	3.77	-2.68	3.39	No
917	Kyrgyz Republic	1995	2009	15	-16.53	1.38	-5.28	4.68	No
918	Bulgaria	1999	2009	11	0.09	4.80	3.20	1.43	Yes
921	Moldova	2001	2009	9	-6.32	4.99	1.17	3.14	Yes
923	Tajikistan	2005	2009	5	-7.96	2.16	-3.93	3.95	No
924	China	1984	2009	26	-3.04	1.32	-1.46	0.93	Yes
926	Ukraine	1998	2009	12	-4.50	1.83	-0.89	1.95	Yes
935	Czech Republic	1996	2009	14	-5.53	0.55	-2.88	1.85	Yes
936	Slovak Republic	1996	2009	14	-4.62	-0.27	-1.89	1.32	Yes
939	Estonia	1995	2009	15	-3.80	3.40	0.31	2.29	Yes
941	Latvia	1994	2009	16	-11.33	1.10	-1.69	2.91	Yes
944	Hungary	1990	2009	18	-5.37	6.52	0.67	3.68	No
946	Lithuania	1994	2009	16	-9.12	0.33	-2.55	2.73	Yes
960	Croatia	1994	2009	16	-5.55	2.44	-1.34	2.01	Yes
961	Slovenia	1994	2009	16	-4.99	2.04	0.10	1.49	Yes
963	Bosnia & Herzegovina	1998	2009	12	-6.62	2.93	-1.84	2.73	No
964	Poland	1993	2009	17	-3.51	1.37	-0.96	1.60	Yes
968	Romania	1996	2009	14	-5.75	1.67	-1.01	2.13	Yes
	All	1956	2009	2061	-21.6	20.6	0.02	4.07	

Note: Summarized here is the general government primary fiscal balance, defined as the general government overall fiscal balance excluding net interest payments. The data are retrieved from the IMF World Economic Outlook Database (line GGBXI).

a. The regression sample starts from 1990.

Table A4.2
Summary statistics of data

Variable	Number of observations	Mean	Standard deviation	Min	Max
Sample for baseline regressions^a					
Primary fiscal balance (percent of GDP) ^b	793	0.7	3.1	-14.0	13.5
Real GDP growth rate	793	3.9	3.0	-10.9	14.2
Debt-stabilizing primary fiscal balance (percent of GDP) ^c	793	-0.1	2.4	-19.8	14.6
Stock of public debt (percent of GDP) ^d	793	58.5	31.2	3.7	191.6
Private savings (percent of GDP)	793	19.7	6.4	3.0	44.6
Inflation	793	4.7	5.1	-1.4	34.5
Composite risk index	793	75.9	8.9	43.5	94.0
Average real growth rate of largest trade partners ^e	793	3.5	1.6	-0.9	9.3
Extended sample^a					
Primary fiscal balance (% of GDP) ^b	1008	0.4	3.2	-14.0	13.5
Real GDP growth rate	1008	3.5	3.7	-18.5	14.2
Debt-stabilizing primary fiscal balance (% of GDP) ^c	1008	-0.2	2.3	-19.8	14.6
Stock of public debt (% of GDP) ^d	1008	56.9	32.1	3.7	217.6
Private savings (% of GDP)	1008	19.2	6.7	-7.9	45.2
Inflation	1008	5.0	5.3	-1.6	34.5
Composite risk index	1008	75.2	9.0	37.0	94.0
Average real growth rate of largest trade partners ^e	1008	3.1	2.2	-11.0	9.3

a. The sample for baseline regressions covers the period 1990 to 2007, and it excludes three annual observations prior to any fiscal stress episodes. The extended sample, used for various robustness tests, covers the period 1990 to 2009, and it does not exclude any observations prior to fiscal stress episodes.

b. Due to limited data availability, especially for the emerging market economies and low income countries in the sample, the headline primary fiscal balances, rather than cyclically adjusted figures, are used for the estimations.

c. In calculation of the debt-stabilizing primary fiscal balance, the interest-rate and growth differential is calculated as the following: $r_{i,t} - \overline{fwdg}_{i,t}$, where $r_{i,t} = 100 * \frac{\text{Interest payment}_{i,t}}{\text{End-of-period public debt stock}_{i,t-1}}$ is the

implied nominal interest rate on public debt for country i at period t , and $\overline{fwdg}_{i,t}$ is the average of country i 's WEO vintage forecasts on nominal GDP growth at period t for periods $t + 1$ to $t + 5$.

d. The public debt data, retrieved from the Historical Public Debt Database (HPDD), are gross debt for general government, except for countries where only the central government debt information is available.

e. For each country, the five largest trade partners based on 2007 total bilateral trade are selected for the calculation.

Data sources: (a) World Economic Outlook (WEO) Database, IMF; (b) Historical Public Debt Database (HPDD), IMF; (c) Direction of Trade Statistics (DOTS), IMF; (d) International Country Risk Guide (ICRG)

Notes

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1. Summarized in the table is the *general government* primary fiscal balance, defined as the general government overall fiscal balance excluding the *net* interest payments. The data are retrieved from the IMF World Economic Outlook Database (line GGBXI).
2. Some countries achieved such outcome more than once.
3. Botswana and Egypt are not classified as primary commodity exporters by the WEO.
4. In some trial regressions, growth was separated into trend and cyclical components. While both appeared to play a role in most (but not all) specifications, the results were fragile to changes in specifications. Even so, real growth was a robust determinant.
5. Note that, as a result, this is a different variable from the contemporaneous growth rate (*g*) mentioned above.
6. See Bohn (1998) for an early study on the relationship between the primary fiscal balance and the debt-to-GDP ratio in the United States.
7. The Patinkin effect refers to the negative relationship between the inflation rate and real government expenditures. See Patinkin (1993).
8. The International Country Risk Guide (*ICRG*) is compiled by the PRS Group. More detailed information on the database can be found at <http://www.prsgroup.com/>.
9. Following the 2009 update of the WEO Group Aggregates.
10. See IMF Factsheet, The Multilateral Debt Relief Initiative (www.imf.org/external/np/exr/facts/pdf/mdri.pdf). The MDRI beneficiary countries are excluded for two reasons. First, the large one-time debt relief received by these countries caused abnormal movements in their primary fiscal balance. Second, and more important, it is highly likely that these countries had already been on unsustainable debt paths prior to the debt relief. Including them would thus cause bias in the estimation that is intended to predict what an appropriate primary surplus would be.
11. The reason for excluding observations prior to a fiscal stress episode is that if the estimation is used to predict what an appropriate primary surplus would be, based on fundamentals, it is important to leave out those observations where policies were clearly headed in the wrong direction. In the empirical implementation, the chapter follows the definition of fiscal stress episodes by Baldacci, McHugh, and Petrova (2011) and Baldacci et al. (2011).
12. $0.56 = 0.226/(1 - 0.594)$.
13. In some trial regressions, the chapter collapsed the annual observations from 1990 to 2007 into averages for three 6-year periods (1990–1995, 1996–2001, and 2002–2007) and estimated the fixed-effect model using those averages. While the coefficients on inflation were still positive in most cases, many of them became less significant or insignificant, suggesting that the primary balance-enhancing effect might be weaker in the medium term. To ensure that the empirical results were not driven by the inclusion of inflation, all

the robustness check regressions reported in later part of this section were also estimated with inflation excluded. The conclusions on other determinants remained qualitatively unchanged.

14. The data on major political conflict episodes are obtained from the Major Episodes of Political Violence (MEPV) database compiled by the Center for Systemic Peace (<http://www.systemicpeace.org>). The chapter defines major political conflict episodes as periods with the ACTOTAL score greater than 4.

15. This exercise used the April 2011 vintage of the IMF's *WEO* projections on real growth, the public debt stock and other fundamentals for 2016. *Comprisk* for a country takes the value of its latest observation.

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